

TPR

Thermally Protected Resistor

TPR3 Series

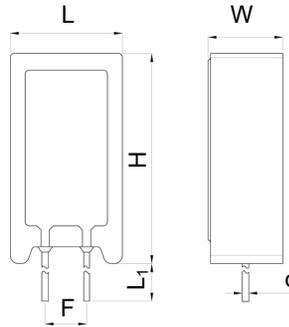
Vertical Installation



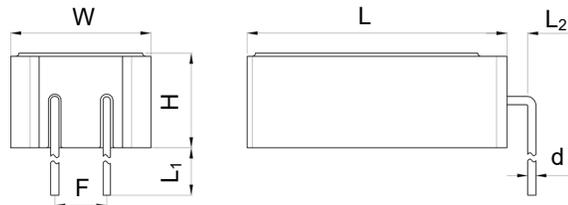
Horizontal Installation



Dimensions (mm)



L	W	H	L ₁ ^a	F	d
11.5 ± 1.0	7.0 ± 1.0	20.5 ± 1.5	3.5 ± 0.5	5.0 ± 1.0	Φ0.55 ± 0.08



L	W	H	L ₁ ^a	F	d	L ₂
20.5 ± 1.5	11.5 ± 1.0	7.0 ± 1.0	3.5 ± 0.5	5.0 ± 1.0	Φ0.55 ± 0.08	1.5 Max.

Note:

a: L₁ can be customized as required from 3.5 mm to 5.0 mm.

Description

Thermally Protected Resistor (TPR) is a unique type of power resistor, where Alloy Thermal-Link (ATCO) and Fusible Wirewound Resistor (RXF) are in series encapsulated in a ceramic case with silicone cement.

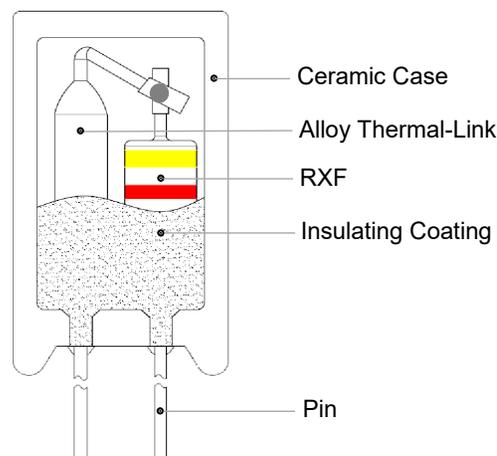
Features

- (20.5 × 11.5 × 7.0) mm
- Over Temp. Protection
- Small Fault Current Protection
- Short Circuit Protection
- Inrush Current Protection
- RoHS Compliant

Applications

- Switch Mode Power Supply (SMPS)
- Adapters
- Home Appliances and Office Appliances (TV, Washer, Fridge, Printer, etc.)

Structure Diagrams



Note: The color of schematic diagram is for reference only

Agency Approvals

Agency	Standards	No.
	UL1412	On going
	SJ 2865	On going

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Technical Parameter

Item	Parameter
Power Type (<i>P</i>)	3 W
Rated Resistance (<i>R</i>)	0.27 Ω ~ 800 Ω
Resistance Tolerance	5% (E24)
Derating Factor (<i>f</i>)	See Rated Power Derating Curve
Actual Power (<i>P</i> ₀)	$P_0 = P \times f$
Rated Current (<i>I</i> _N)	$I_N = \sqrt{P_0 / R}$
Rated Voltage (<i>U</i> _N)	$U_N = \sqrt{P_0 \times R}$
Fusing Time (less than 60 seconds)	25 W (115 °C ≤ <i>T</i> _f ≤ 135 °C) 30 W (145 °C ≤ <i>T</i> _f ≤ 150 °C) 35 W (<i>T</i> _f = 221 °C)
Fusing Temp.	See Specifications
Surge	2.0 kV (<i>R</i> > 10 Ω) 1.0 kV (<i>R</i> ≤ 10 Ω)

Part Numbering System

TPR 3 - 4R7 J 26 L B V - 001

Other Options

Installation Type

V: Vertical Installation
H: Horizontal Installation

Shape

B: Square Shape

Pin Type

L: 2 Pins

ATCO Code

30: H31, *T*_f = 221 °C
27: H7, *T*_f = 150 °C
26: H6, *T*_f = 145 °C
25: H5, *T*_f = 135 °C
24: H4, *T*_f = 130 °C
23: H3, *T*_f = 125 °C
22: H2, *T*_f = 115 °C

Resistance Tolerance

J: ± 5%
K: ± 10%

Resistance

R47: 0.47 Ω
4R7: 4.7 Ω
47R: 47 Ω
470R: 470 Ω

Power Type

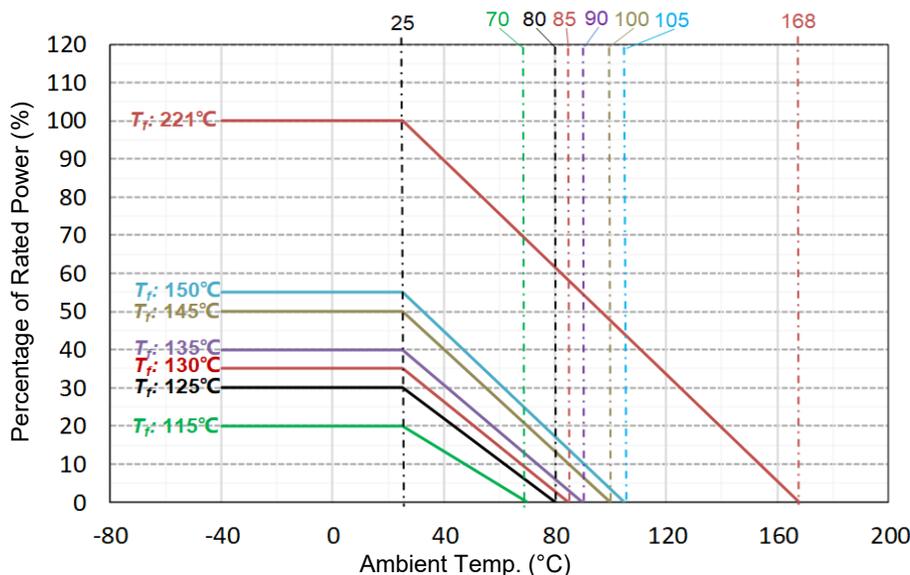
3: 3 W

Product Category

TPR: Thermally Protected Resistor

Rated Power Derating Curve (For Reference Only)

When the ambient temp. exceeds 25 °C, the rated power value declines as the following curve.



Specifications

Blue Font Is SETsafe | SETfuse Common Specifications

Model	Power Type	Derating Factor (25 °C)	Rated Functioning Temp. (T _f)	Fuse Temp. (°C)	Re-sistance Range (Ω)	Re-sistance Tolerance (%)	Agency Approvals		Environmental Status
									RoHS
	(W)	(%)	(°C)	(°C)	(Ω)	(%)	cURus	CQC	RoHS
TPR3-xxxx30LB	3	100	221	216 ~ 221	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx27LB	3	55	150	143 ~ 150	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx26LB	3	50	145	138 ~ 145	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx25LB	3	40	135	128 ~ 135	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx24LB	3	35	130	123 ~ 130	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx23LB	3	30	125	119 ~ 125	0.27 ~ 800	± 5	On going	On going	●
TPR3-xxxx22LB	3	20	115	109 ~ 115	0.27 ~ 800	± 5	On going	On going	●

Resistance Selection Table (According to IEC60063-2015 E24)

Rated Resistance (Ω)	Code						
0.10	R10	1.0	1R0	10	10R	100	100R
0.11	R11	1.1	1R1	11	11R	110	110R
0.12	R12	1.2	1R2	12	12R	120	120R
0.13	R13	1.3	1R3	13	13R	130	130R
0.15	R15	1.5	1R5	15	15R	150	150R
0.16	R16	1.6	1R6	16	16R	160	160R
0.18	R18	1.8	1R8	18	18R	180	180R
0.20	R20	2.0	2R0	20	20R	200	200R
0.22	R22	2.2	2R2	22	22R	220	220R
0.24	R24	2.4	2R4	24	24R	240	240R
0.27	R27	2.7	2R7	27	27R	270	270R
0.30	R30	3.0	3R0	30	30R	300	300R
0.33	R33	3.3	3R3	33	33R	330	330R
0.36	R36	3.6	3R6	36	36R	360	360R
0.39	R39	3.9	3R9	39	39R	390	390R
0.43	R43	4.3	4R3	43	43R	430	430R
0.47	R47	4.7	4R7	47	47R	470	470R
0.51	R51	5.1	5R1	51	51R	510	510R
0.56	R56	5.6	5R6	56	56R	560	560R
0.62	R62	6.2	6R2	62	62R	620	620R
0.68	R68	6.8	6R8	68	68R	680	680R
0.75	R75	7.5	7R5	75	75R	750	750R
0.82	R82	8.2	8R2	82	82R	N/A	N/A
0.91	R91	9.1	9R1	91	91R	N/A	N/A

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Glossary

Item	Description
RXF	Fusible Wirewound Resistor A power resistor which is made by winding a resistive element on a ceramic core, and the core is coated by insulation coating. It intends to interrupt a current flow at a predetermined time when the current exceeds the predetermined value, It is non-resettable.
ATCO	Alloy Thermal-Link Alloy Type Thermal-Link, alloy is the thermal element. Thermal-Link is A non-resettable device incorporating a THERMAL ELEMENT which will open a circuit once only when exposed for a sufficient length of time to a temp. in excess of that for which it has been designed.
R	Rated Resistance Resistance value for which the resistor has been designed, and which is generally used for denomination of the resistor.
I_N	Rated Current $I_N \equiv \sqrt{\text{Actual Power} / R}$
U_N	Rated Voltage The d.c. or a.c. r.m.s. voltage calculated from the square root of the product of the rated resistance and the rated dissipation.
T_f	Rated Functioning Temp. The temp. of the Thermal-Link which causes it to change its state of conductivity with a detection current up to 10 mA as the only load.
Fusing Temp.	Fusing Temp. The temp. of the TPR which causes it to change its state of conductivity is measured with silicone oil bath in which the temp. is increased at the rate of 0.3 °C to 0.5 °C / min, with a detection current up to 10 mA as the only load.

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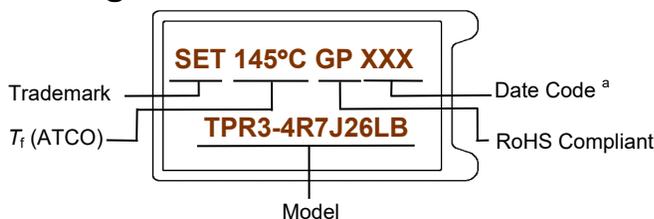
Agency Approvals of RXF

Rated Power	Resistance Range	Agency Approvals		
				
(W)	(Ω)	cURus	VDE	CQC
1	0.47 ~ 51	●	●	●
	0.27 ~ 800	●	N/A	N/A

Agency Approvals of ATCO

Code	Model	Rated Functioning Temp.	Agency Approvals				
							
		(°C)	cURus	TUV	PSE	CCC	KC
30	H31	221	●	●	N/A	●	N/A
27	H7	150	●	●	●	●	●
26	H6	145	●	●	●	●	●
25	H5	135	●	●	●	●	●
24	H4	130	●	●	●	●	●
23	H3	125	●	●	●	●	●
22	H2	115	●	●	●	●	●

Marking



Note:

a: The first XX means production year code,

The last X means production quarter code.

eg: "191" means that the production time is the first quarter of Y2019.

Note: The color of schematic diagram is for reference only

Operating Principle

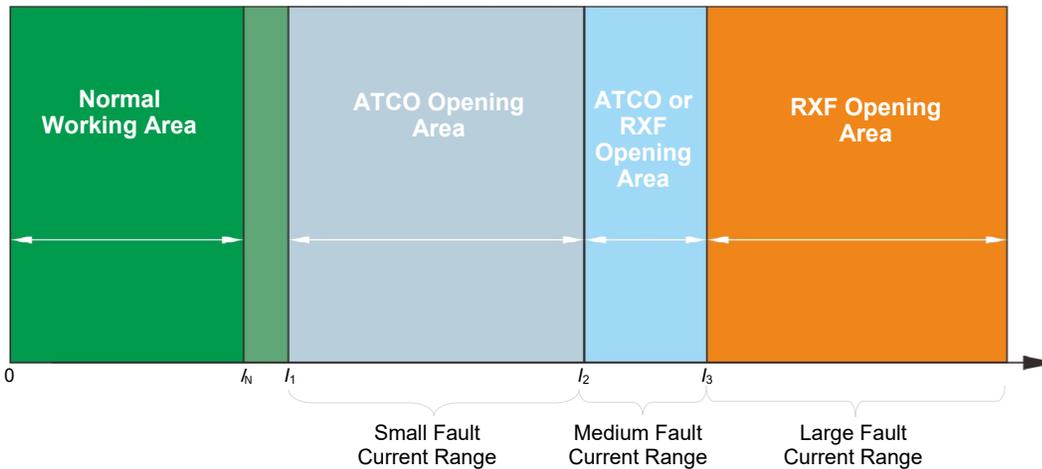
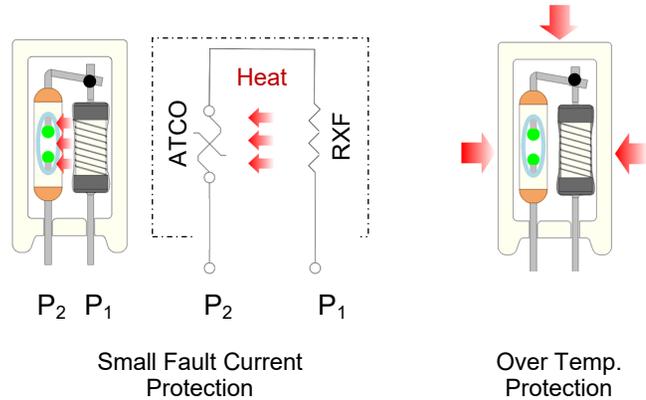
Instruction:

$$R_{RXF} \geq 100R_{ATCO}$$

- R_{RXF} : The Resistance Value of RXF
- R_{ATCO} : The Resistance Value of ATCO

$$T_{RXF} \geq 5T_{ATCO}$$

- The Fusing Temp. of RXF (T_{RXF}): 1,200 °C ~ 1,500 °C
- The Fusing Temp. of ATCO (T_{ATCO}): 115 °C ~ 221 °C



I_N is rated current

I_1 is conventional fusing current

● Small Fault Current Protection

At small fault current, $I_1 < I < I_2$, ATCO senses the heat that generated by RXF, when the ATCO reaches the fusing Temp., ATCO opens the circuit quickly. In this case, RXF keeps intact and ATCO opens.

● Medium Fault Current Protection

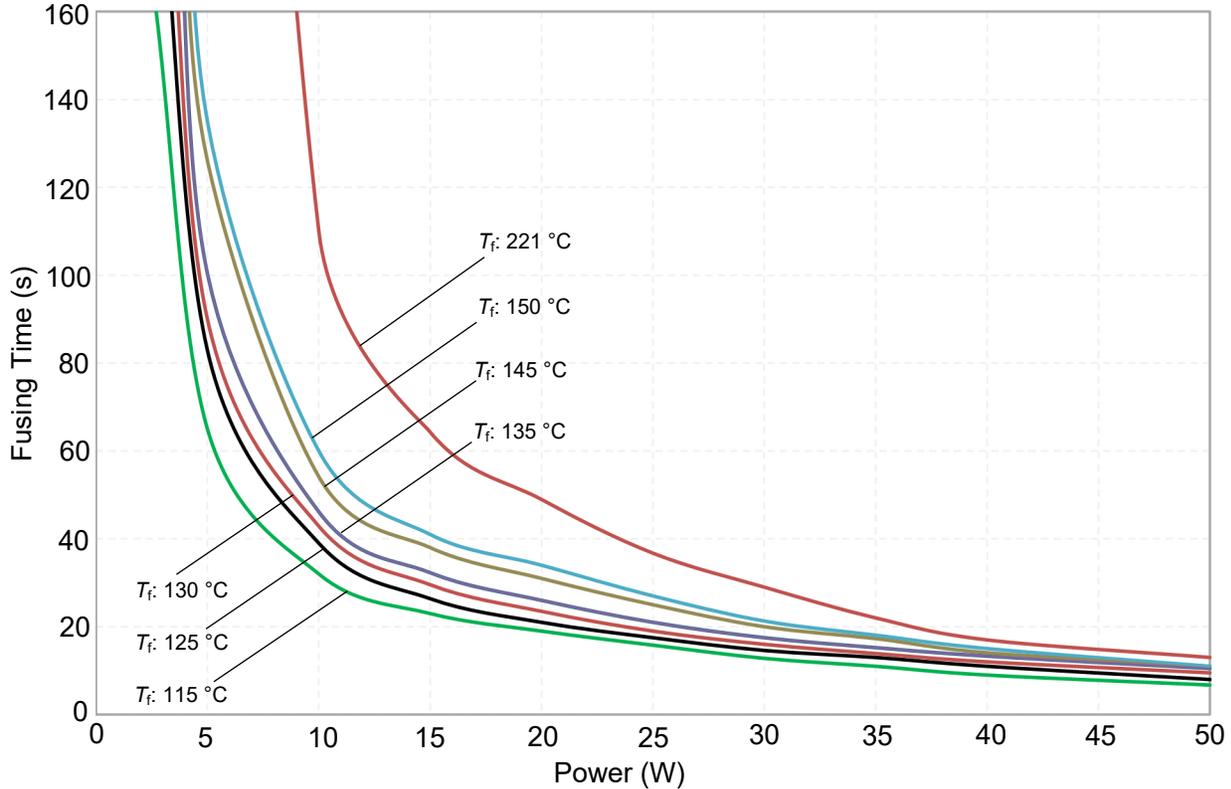
At medium fault current, $I_2 < I < I_3$, RXF opens in a short time because of much heat generated, meanwhile, RXF conducts its residual heat to ATCO. In this case, both RXF and ATCO open.

● Large Fault Current Protection (Short-Circuit Protection)

At large fault current, such as short circuit, $I > I_3$, RXF opens instantly but ATCO keeps intact because the fusing time of RXF is too short to generate enough heat. In this case, RXF opens and ATCO keeps intact.

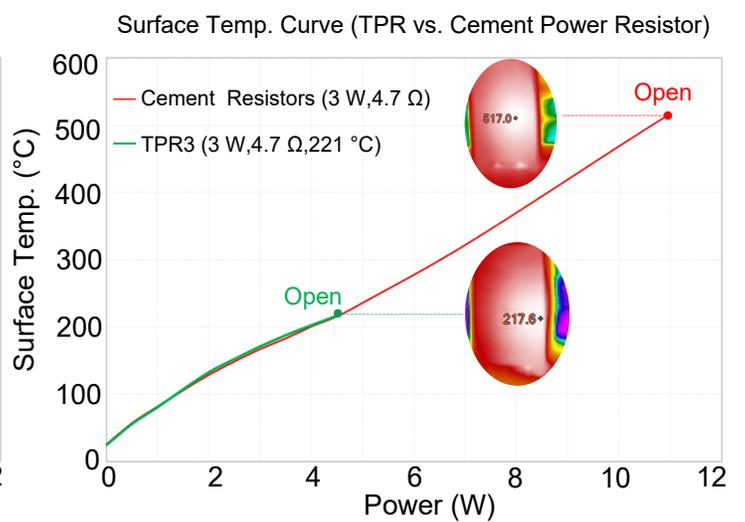
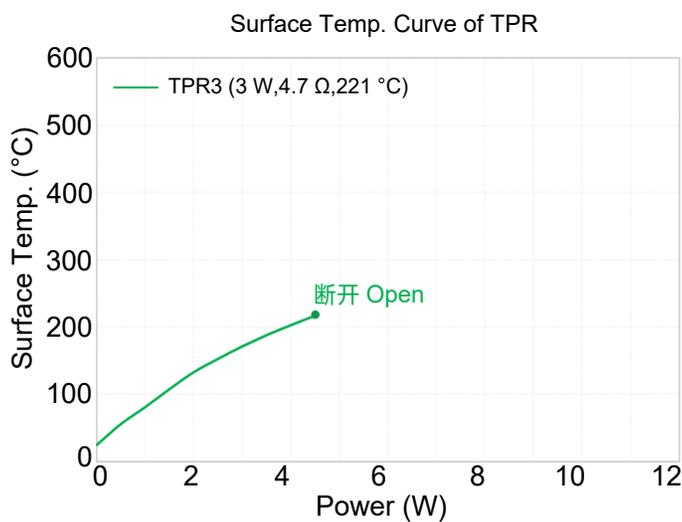
Fusing Time Current (For Reference Only)

TPR can open effectively at lower power multiples to protect the circuit timely (ambient temp. 25 °C ± 2°C).



Surface Temp. Curve (For Reference Only)

The surface temp. of TPR is always at a lower level, when small fault current happens to the device, TPR is able to open the circuit timely without additional damage (ambient temp. 25 °C ± 2°C).



Performance Test

Mechanical Performance Test

Item	Test Condition	Criterion
Tensile Test	A pin withstand 10 N × 60 seconds	No Visible Damage, $\Delta R \leq \pm (1\%R + 0.05 \Omega)$
Twist Test	A pin 2 mm away from body, bent 90°, twist 180° × 2 times	No Visible Damage, $\Delta R \leq \pm (1\%R + 0.05 \Omega)$

Environmental Test

Item	Test Condition	Criterion
Temp. Cycle	1. - 55 °C × 30 minutes 2. Room Temp. × (10 to 15) minutes 3. 85 °C × 30 minutes 4. Room Temp. × (10 to 15) minutes 5. 5 Cycles from Step 1 to Step 4	$\Delta R \leq \pm (2\%R + 0.05 \Omega)$

Electrical Performance Test

Item	Test Condition	Criterion
Short-Time Overload	$2.5U_N \times 5$ seconds	Legible Marking, No Visible Damage $\Delta R \leq \pm (2\%R + 0.05 \Omega)$
Insulation Resistance	Foil Method: Apply 500 VDC between lead wire and the metal foil.	Insulation Resistance $\geq 1,000 M\Omega$
Voltage Proof	Foil Method: Apply 900 VAC × 1 minute between pin and the metal foil.	No Breakdown or Flashover
Surge Test	Combination Wave Generator (1.2/50 μ s, 8/20 μ s, 2 Ω), 10 Times, 1 minute Interval.	Resistor shall not open after the test
Fusing Test	Apply test current to the resistor (constant current source).	Fusing Time ≤ 60 seconds
Solderability	Solder Bath (non-activated flux), Soldering Powder: 25% Rosin Alcohol, Depth of Immersion (From the seating plane or component body): (1.5 to 2.0) mm, Time of Immersion: (2.5 \pm 0.5) seconds.	Soldering Area $\geq 95\%$
Fusing Temp.	Silicone oil bath: temp. rise rate is 0.3 °C/min to 0.5 °C/min, detection current ≤ 10 mA.	216 °C ~ 221 °C ($T_f = 221$ °C) 143 °C ~ 150 °C ($T_f = 150$ °C) 138 °C ~ 145 °C ($T_f = 145$ °C) 128 °C ~ 135 °C ($T_f = 135$ °C) 123 °C ~ 130 °C ($T_f = 130$ °C) 119 °C ~ 125 °C ($T_f = 125$ °C) 109 °C ~ 115 °C ($T_f = 115$ °C)

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Soldering Parameters

Recommended Hand-Soldering Parameters

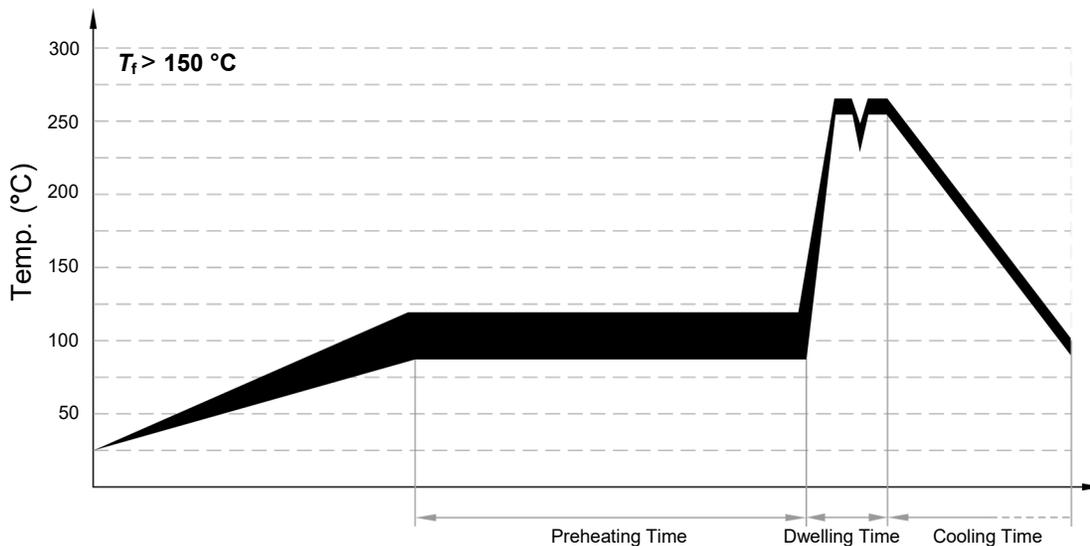
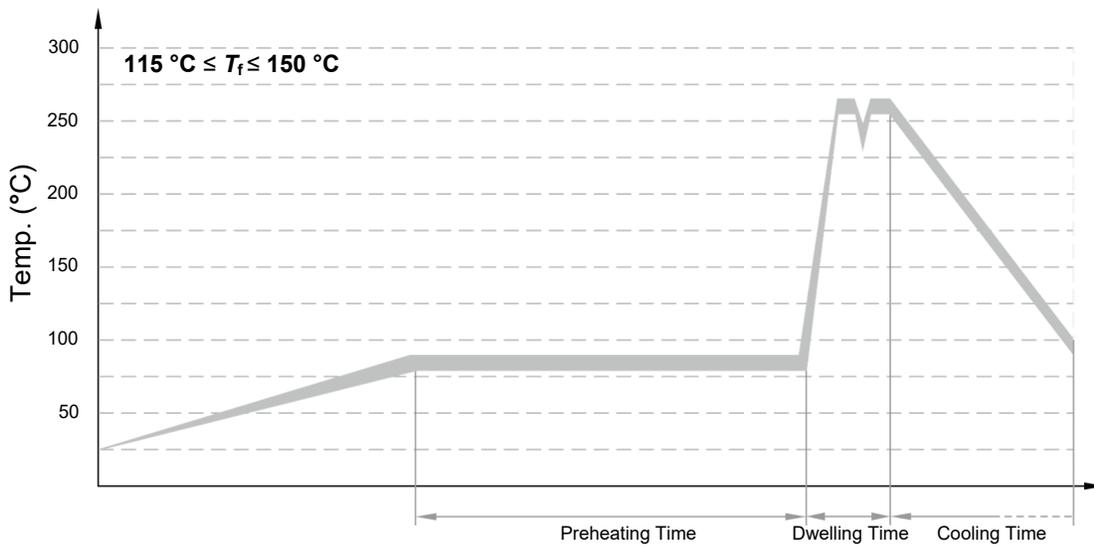
Solder Iron Temp.: $(350 \pm 5) ^\circ\text{C}$

Soldering Time: 2 seconds Max. ($115 ^\circ\text{C} \leq T_f \leq 150 ^\circ\text{C}$)

3 seconds Max. ($T_f > 150 ^\circ\text{C}$)

Wave Soldering Parameters

The Wave Soldering Parameters are for reference only, before TPR is for practice usage, relative validation is recommended.

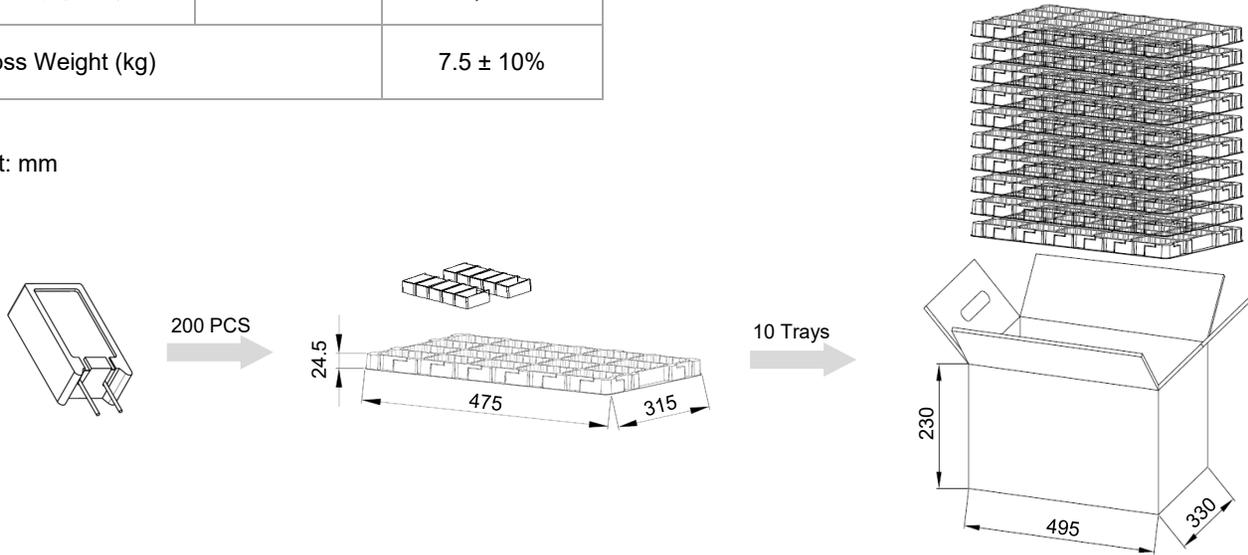


Item	Temp. (°C)		Time (second)
	$115 ^\circ\text{C} \leq T_f \leq 150 ^\circ\text{C}$	$T_f > 150 ^\circ\text{C}$	
Preheating	80 ~ 90	90 ~ 120	60 ~ 100
	260 ± 5	260 ± 5	
Dwelling	260 ± 5	260 ± 5	4 ~ 5

Packaging Information (For Reference Only)

Item	Tray	Carton
Quantity (PCS)	200	2,000
Gross Weight (kg)		7.5 ± 10%

Unit: mm





ATTENTION

Cold Resistance Test

1. If product TCR is not less than 350 ($10^{-6}/^{\circ}\text{C}$), the measured resistance value shall be corrected as the relative resistance value under 25 °C according to TCR formula.
2. Resistance Measurement (4-terminal test).

Replacement

As TPR is a non-resettable product, for safety sake, please use the same type of TPR for replacement.

Usage

1. Do not touch the resistor body or pins directly when power is on, to avoid burn or electric shock.
2. When air pressure is from 80 kPa to 106 kPa, the relative altitude shall be +2000 m to - 500 m.

Storage

1. Please store TPR with ambient temp. 10 °C ~ 30 °C and relative humidity 30% ~ 75%.
2. Do not store the TPR at the high temp., high humidity or corrosive gas environment, avoid influencing the solderability of the pins, please use them up within 1 year after receiving the goods.